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No Drill, No Spill: The Truth About Fracking

Christine Sampson
College of DuPage

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by Christine Sampson

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Abstract
Hydraulic fracturing is raising controversy in multiple states and countries. The process and chemicals involved are generally unknown to the public, which raises concerns. Scientists are debating and people are protesting for both sides of the issue. This paper discusses hydraulic fracturing to include environmental impacts and possible resolutions.

What is Hydraulic Fracturing?

Hydraulic fracturing, also known as fracking, is an advanced process to extract natural gas from deep layer shale found throughout the United States and in other select places of the world. Major gas reserves are found in the United States, Venezuela, Canada, France, Mexico, Argentina, China, and Australia; all of which are currently fracking or on their way to it (Engelder et al 2011). Many environmental issues are associated with fracking.

Fracking is a generally simple process. Typically, four to five acres of land are cleared and a well drilled. The drill will bore down 5,000 feet or more to reach the shale layer and then will turn 90° to continue horizontally for up to a mile. The drill bit is then retracted and a pipe inserted through the length of the bore and encased in cement. After the pipe is secure, water, sand, and chemicals are pumped down the well at high pressure to fracture the rock and release the gas. The gas then comes up with some of the fluids, or flowback water, and is captured. Over 99% of the mixture is freshwater and sand, the remainder chemicals. The flowback water is held in surface ponds or tanks until treatment or re-use (Mooney 2011). Shale is fracked in approximately 1,000 foot stages, with five stages per horizontal bore. Each well can hold up to twelve horizontal bores. To obtain as much gas as possible, companies drill multiple closely spaced vertical wells at a single site.

With new technologies allowing the horizontal drilling, more layers of shale are accessible which has caused a rush for natural gas. The United States is estimated to hold approximately 827 trillion cubic feet of accessible shale gas, which is enough to last decades (Mooney 2011). Natural gas is a cleaner alternative to other fossil fuels like coal and oil, reporting 40% less carbon emissions, and is depicted as being a bridge fuel to renewable energy. Experts are concerned though that even with new technology increasing the availability of natural gas, the accompanying environmental and health risks might be too high (Engelder et al 2011).

The Risks and Concerns

The main risk and concern attributed to fracking is groundwater contamination. There is an abundance of public concern about drinking water contamination, especially in Pennsylvania where a large piece of the Marcellus shale lies. Drilling of shale in the Appalachian basin is increasing at a rapid rate which raises more concerns about the impact on water sources. In a study by Jackson et al (2011) active gas wells were linked to groundwater contamination. (Jackson et al 2011). The study tested 68 private groundwater wells of varying depths, some in active areas and others in non-extraction areas. Traces of methane and other chemicals were found in 51 of the wells, but the origins were different in respect to the area. Chemicals found in the active areas were of thermogenic origin, meaning they originated in deeper layers, while chemicals found in non-extraction areas were of biogenic origin. It was also discovered that the concentration of methane and other chemicals like ethane increased with proximity to a gas well. Some concentrations were even found at explosion and fire hazard levels.

The study by Jackson et al (2011) provided evidence of methane contamination of ground water associated with natural gas extraction from shale. Other studies have likely documented this conclusion throughout the United States and in Canada. The cause of these contaminations is still up for debate. Some say it could be due to the wells creating new fractures or enlarging old ones in the rock, causing new connections between cracks and in some areas an increase in earthquakes (Jackson et al 2011). Another answer is that pipes and bores leak gas and chemicals into nearby aquifers. There is an uneven gap in between the bore and steel pipe, leaving room for gas and other chemicals or fluids to escape if not properly and effectively cemented. It is also unclear how long the cement put in place can last. A significant percentage of cement jobs fail almost immediately. Even if the metal casing of the pipe is compromised, methane can escape (Fischetti 2013).

There are several effects of water contamination, especially on the local ecosystem. People report being able to light their faucets on fire, bubbly tap water, diminishing air quality in the surrounding areas, and a multitude of health issues. An advocacy group in New York sent a list of 54 recorded chemicals used in fracking wells to Endocrine Disrupters Exchange for testing (Fischetti 2010). The results showed that several of the chemicals fell into one or more of fourteen categories for potential health concern including tissue and organ damage. Air quality tests in Dish, Texas, discovered xylene, benzene, and other toxins at levels above legal limit (Fischetti 2010). Another source for water contamination is the handle of flowback water. Up to 75% of the chemical mixture pumped down the well comes back up. These fluids bring up other deep materials with them adding to their toxicity and dissolved solids levels. Numerous drilling companies use open-air pits to hold the flowback water. This practice exposes local water sources to contamination by leakage or overflows. A series of New York Times articles focused on the contamination of Pennsylvania river basins that resulted from poor handling of flowback water (Mooney 2011).

Fracking is also highly wasteful. Horizontal fracking techniques require large volumes of water and chemicals, up to 15,000 gallons per well, along with huge ponds or tanks to store the flowback water. Transportation of supplies and natural gas includes dozens of trucks, tankers, and storage containers (Mooney 2010). Another big concern does not lie in the process, but the industry. Drilling is expanding and spreading. In 2005 there were only two Pennsylvania drill sites. By 2009 there were 768. Most concerns are based on the chemicals used and low level of public knowledge of them. Companies are supposed to have data sheets available to the public listing the chemicals used, but do not have to include how they are mixed or how they are used (Fischetti 2010). In comparison to other fossil fuel extractions, fracking is overall poorly regulated federally in the United States.

Fracking wastes are not considered a hazardous waste under the Resource Conservation and Recovery Act. Gas wells are not covered under the Safe Drinking Water Act due to something known as the Halliburton loophole created with the signing of the 2005 Energy Policy Act. Only in recent years has the EPA (Environmental Protection Agency) asked companies to report a list of constituents in their fracking fluids (Jackson et al 2011).

Global Perspective

Fracking is present in countries outside of the United States and environmental issues are similar around the world. Australia has had similar reports of contamination as those made in Pennsylvania and the Western United States (Engelder et al 2011). With fracking expanding, contamination is happening on a larger scale.

Proposed Solutions

With a lack of public knowledge of the chemicals in frack fluids being a main issue, one resolution would be for full disclosure of the chemicals being pumped into the ground. In the case of water source contamination, advanced tests like testing for trace chemicals and tougher regulations would be a big step in the right direction. More studies by the EPA and future monitoring with models and simulations like Touch 2 could greatly help scientists understanding of the lasting effects from fracking (Mooney 2011). Both of these could lend to more stringent regulations being laid out and roadblocks for natural gas companies.

Of course, fracking should not be the answer. Renewable energy is the smarter way to go and contrary to criticism, is possible. In terms of wind energy, studies have found that there is nothing standing in the way to power the entire planet through wind turbines (Archer and Jacobson 2012). Solar energy is booming as prices for panels are becoming competitive to other energy sources. Technology supporting renewable energy is advancing as well. Natural gas is not necessary, therefore fracking is not either.

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